

WHAT IS CLAIMED IS:

1. A method of purifying polluted soil which contains a pollutant, comprising the steps of: heating the polluted soil to make the soil emit the pollutant  
5 and bringing the emitted pollutant into contact with functional water under light irradiation to decompose the pollutant.

10 2. A method of purifying polluted soil which contains pollutant, comprising the steps of: heating the polluted soil to make the soil emit a gas containing the pollutant;

15 passing a gas through functional water to generate a gas containing chlorine;  
mixing the pollutant-containing gas and the chlorine-containing gas to form a gaseous mixture; and  
irradiating the gaseous mixture with light to decompose the pollutant.

20 3. The method of purifying polluted soil according to claim 1 or 2, wherein the heating is conducted using a heater.

25 4. The method of purifying polluted soil according to claim 1 or 2, wherein the heating is conducted by mixing the polluted soil with an inorganic compound which reacts exothermically with water.

5. The method of purifying polluted soil according to claim 4, wherein rolling processing is conducted after mixing the polluted soil with the inorganic compound.

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6. The method of purifying polluted soil according to claim 4, wherein stirring processing is conducted after mixing the polluted soil with the inorganic compound.

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7. The method of purifying polluted soil according to claim 4, wherein the inorganic compound is at least one selected from the group consisting of quick lime, magnesium oxide, barium oxide, strontium oxide, sodium oxide, potassium oxide, and anhydrides of calcium sulfate and magnesium sulfate, respectively.

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20 8. The method of purifying polluted soil according to claim 4, wherein the water content of the polluted soil is 10 to 30% by weight.

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9. The method of purifying polluted soil according to claim 1 or 2, wherein the functional water is water produced by electrolysis of water containing an electrolyte.

10. The method of purifying polluted soil

according to claim 9, wherein the functional water is acid functional water produced in the vicinity of an anode by the electrolysis of the water containing an electrolyte.

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11. The method of purifying polluted soil according to claim 9, wherein the electrolyte is at least one selected from the group consisting of sodium chloride and potassium chloride.

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12. The method of purifying polluted soil according to claim 1 or 2, wherein the functional water is an aqueous solution containing hypochlorous acid.

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13. The method of purifying polluted soil according to claim 12, wherein the functional water containing hypochlorous acid is a hypochlorite aqueous solution.

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14. The method of purifying polluted soil according to claim 13, wherein the hypochlorite is at least one selected from the group consisting of sodium hypochlorite and potassium hypochlorite.

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15. The method of purifying polluted soil according to claim 12, wherein the functional water further contains an inorganic acid or an organic acid.

16. The method of purifying polluted soil  
according to claim 15, wherein the inorganic acid or  
the organic acid is at least one selected from the  
group consisting of hydrochloric acid, hydrofluoric  
5 acid, oxalic acid, sulfuric acid, phosphoric acid,  
boric acid, acetic acid, formic acid, malic acid and  
citric acid.

17. The method of purifying polluted soil  
10 according to claim 1 or 2, wherein the functional water  
has a hydrogen ion concentration (pH value) of 1 to 4,  
an oxidation-reduction potential (working electrode:  
platinum electrode, reference electrode: silver-silver  
chloride electrode) of 800 to 1500 mV, and a chlorine  
15 concentration of 5 to 150 mg/l.

18. The method of purifying polluted soil  
according to claim 1 or 2, wherein the functional water  
has a hydrogen ion concentration (pH value) of 4 to 10,  
20 an oxidation-reduction potential (working electrode:  
platinum electrode, reference electrode: silver-silver  
chloride electrode) of 300 to 1100 mV, and a chlorine  
concentration of 2 to 100 mg/l.

25 19. The method of purifying polluted soil  
according to claim 1 or 2, wherein the light comprises  
a light whose wavelength is in the range of 300 to 500

nm.

20. The method of purifying polluted soil  
according to claim 1 or 2, wherein the pollutant is a  
5 halogenated aliphatic hydrocarbon.

21. The method of purifying polluted soil  
according to claim 20, wherein the halogenated  
aliphatic hydrocarbon is an aliphatic hydrocarbon  
10 compound having at least one selected from the group  
consisting of chlorine substituent and fluorine  
substituent.

22. The method of purifying polluted soil  
15 according to claim 21, wherein the halogenated  
aliphatic hydrocarbon is at least one selected from the  
group consisting of trichloroethylene, 1,1,1-  
trichloroethane, tetrachloroethylene, cis-1,2-  
dichloroethylene, chloroform and dichloromethane.

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23. The method of purifying polluted soil  
according to claim 1 or 2, further comprising the step  
of allowing an adsorption material to adsorb the  
pollutant.

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24. The method of purifying polluted soil  
according to claim 2, wherein the chlorine

concentration of the gaseous mixture is in the range of 5 ppm to 1000 ppm.

25. The method of purifying polluted soil  
5 according to claim 24, wherein the chlorine concentration of the gaseous mixture is in the range of 20 ppm to 500 ppm.

26. The method of purifying polluted soil  
10 according to claim 2, wherein the gas passed through the functional water is the gas containing the pollutant extracted from the polluted soil.

27. An apparatus for purifying polluted soil  
15 which contains a pollutant, comprising a means for heating the polluted soil to make the soil emit the pollutant, a means for bringing the emitted pollutant into contact with functional water, and a means for irradiating the functional water with light.

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28. An apparatus for purifying polluted soil  
which contains a pollutant, comprising:  
a gas-emitting means for heating the polluted soil  
to make the soil emit a gas containing the pollutant;  
25 a chlorine-containing gas generating means for  
generating a gas containing chlorine by passing a gas  
through functional water;

a mixing means for mixing the pollutant-containing gas and the chlorine-containing gas so as to form a gaseous mixture; and

5 a light irradiation means for irradiating the gaseous mixture with light.

29. The apparatus for purifying polluted soil according to claim 27 or 28, wherein the heating is conducted using a heater.

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30. The apparatus for purifying polluted soil according to claim 27 or 28, wherein the heating is conducted by mixing the polluted soil with an inorganic compound which reacts exothermically with water.

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31. The apparatus for purifying polluted soil according to claim 27 or 28, wherein the functional water is water produced by electrolysis of water containing an electrolyte.

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32. The apparatus for purifying polluted soil according to claim 27 or 28, wherein the functional water is an aqueous solution containing hypochlorous acid.

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33. The apparatus for purifying polluted soil according to claim 27 or 28, wherein the functional

water has a hydrogen ion concentration (pH value) of 1 to 4, an oxidation-reduction potential (working electrode: platinum electrode, reference electrode: silver-silver chloride electrode) of 800 to 1500 mV, 5 and a chlorine concentration of 5 to 150 mg/l.

34. The apparatus for purifying polluted soil according to claim 27 or 28, wherein the functional water has a hydrogen ion concentration (pH value) of 4 10 to 10, an oxidation-reduction potential (working electrode: platinum electrode, reference electrode: silver-silver chloride electrode) of 300 to 1100 mV, and a chlorine concentration of 2 to 100 mg/l.

15 35. The apparatus for purifying polluted soil according to claim 27 or 28, wherein the light in the means for irradiating the functional water with the light comprises a light whose wavelength is in the range of 300 to 500 nm.

20 36. The apparatus for purifying polluted soil according to claim 28, wherein the means for heating the polluted soil is a rotary kiln.

25 37. The apparatus for purifying polluted soil according to claim 28, wherein the chlorine concentration of the gaseous mixture is in the range of

5 ppm to 1000 ppm.

38. The apparatus for purifying polluted soil according to claim 37, wherein the chlorine 5 concentration of the gaseous mixture is in the range of 20 ppm to 500 ppm.

39. The apparatus for purifying polluted soil according to claim 28, wherein the gas which is passed 10 through the functional water is the gas containing the pollutant extracted from the polluted soil.

40. An apparatus for generating a chlorine-containing gas, comprising:

15 a containing means for containing functional water;

a functional water-supplying means for supplying the functional water to the containing means;

20 a first gas-supplying means for supplying a gas through the functional water to generate a gas containing chlorine derived from the functional water;

a second gas-supplying means for supplying the chlorine-containing gas to another containing means;

and

25 a concentration-measuring means for measuring the concentration of the chlorine-containing gas;

the functional water-supplying means, the first

gas-supplying means, the second gas-supplying means and the concentration-measuring means being connected to the containing means, respectively.

5           41. The apparatus for generating a chlorine-containing gas according to claim 40, wherein the gas passed through the functional water does not react with the functional water.

10           42. The apparatus for generating a chlorine-containing gas according to claim 40, wherein a great number of bubbles are created in the functional water by the passing of the gas therethrough.

15           43. The apparatus for generating a chlorine-containing gas according to claim 40, wherein the first gas-supplying means is controlled depending on the concentration of the chlorine-containing gas measured by the concentration-measuring means.

20           44. The apparatus for generating a chlorine-containing gas according to claim 40, wherein the functional water-supplying means is controlled depending on the concentration of the chlorine-containing gas measured by the concentration-measuring means.

45. An apparatus for decomposing a polluted gas, comprising the apparatus for generating a chlorine-containing gas according to claim 40;

5 a gas-containing means for containing a plurality of gases including a chlorine-containing gas supplied by the second gas-supplying means of the apparatus for generating a chlorine-containing gas;

10 a polluted gas-supplying means for supplying a polluted gas to the gas-containing means; and

15 a light irradiating means for irradiating the gases contained in the gas-containing means with light; the polluted gas-supplying means being connected to the gas-containing means.

15 46. The apparatus for decomposing a polluted gas according to claim 45, wherein the second gas-supplying means is connected to the gas-containing means.

20 47. The apparatus for decomposing a polluted gas according to claim 45 or 46, wherein a concentration-measuring means is arranged in the gas-containing means.

25 48. The apparatus for decomposing a polluted gas according to claim 47, wherein the concentration of the chlorine-containing gas supplied by the second gas-supplying means or that of the polluted gas supplied by

the polluted gas-supplying means in the gas-containing means is measured by the concentration-measuring means arranged in the gas-containing means.

5           49. The apparatus for decomposing a polluted gas according to claim 48, wherein at least one of the concentration of the chlorine-containing gas, the irradiation intensity of the light irradiating means and the flow rate of the polluted gas is controlled depending on the measured values of the concentration-measuring means.

10           50. The apparatus for decomposing a polluted gas according to claim 48, wherein at least one of the flow rate of the chlorine-containing gas, the irradiation time of the light irradiating means and the flow rate of the polluted gas is controlled depending on the measured values of the concentration-measuring means.

15           51. The apparatus for decomposing a polluted gas according to claim 45, wherein the polluted gas-supplying means is connected to the polluted soil-containing means for containing the polluted soil and can supply the polluted gas emitted from the polluted soil to the gas-containing means.

20           52. The apparatus for decomposing a polluted gas

according to claim 51, wherein the polluted soil-containing means is provided with a heating means.

53. The apparatus for decomposing a polluted gas  
5 according to claim 51 or 52, wherein the polluted soil-containing means is provided with a stirring means for stirring the polluted soil contained therein.

54. The apparatus for decomposing a polluted gas  
10 according to claim 52 or 53, wherein the polluted soil-containing means is provided with a concentration-measuring means for measuring the concentration of a gas emitted from the polluted soil contained therein.

15 55. The apparatus for decomposing a polluted gas according to claim 52 or 53, wherein the heating means or the stirring means is controlled depending on the measured values of the concentration-measuring means for measuring the concentration of the gas emitted from  
20 the polluted soil.

56. The method of purifying polluted soil according to claim 5, wherein the inorganic compound is at least one selected from the group consisting of  
25 quick lime, magnesium oxide, barium oxide, strontium oxide, sodium oxide, potassium oxide, and anhydrides of calcium sulfate and magnesium sulfate, respectively.

57. The method of purifying polluted soil according to claim 6, wherein the inorganic compound is at least one selected from the group consisting of quick lime, magnesium oxide, barium oxide, strontium oxide, sodium oxide, potassium oxide, and anhydrides of calcium sulfate and magnesium sulfate, respectively.

58. The method of purifying polluted soil according to claim 10, wherein the electrolyte is at least one selected from the group consisting of sodium chloride and potassium chloride.

59. The method of purifying polluted soil according to claim 13, wherein the functional water further contains an inorganic acid or an organic acid.

60. The method of purifying polluted soil according to claim 14, wherein the functional water further contains an inorganic acid or an organic acid.

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61. The apparatus for decomposing a polluted gas according to claim 53, wherein the polluted soil-containing means is provided with a concentration-measuring means for measuring the concentration of a gas emitted from the polluted soil contained therein.

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62. The apparatus for decomposing a polluted gas

according to claim 53, wherein the heating means or the stirring means is controlled depending on the measured values of the concentration-measuring means for measuring the concentration of the gas emitted from the 5 polluted soil.